

Documentation of *Hovenia acerba* as a distinct taxon newly recorded from the Western Himalaya with its distribution and IUCN conservation status

Iftikar H. Khan

Department of Wildlife Protection Rajouri Range, Jammu and Kashmir 185131, India

Udhay Sharma

University of Jammu, Jammu and Kashmir

Om Prakash Vidyarthi

JK Biodiversity Council, Jammu and Kashmir

Namrata Sharma

University of Jammu, Jammu and Kashmir

Sunit Singh

sunitsingh964@gmail.com

University of Jammu, Jammu and Kashmir

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Abstract

Hovenia acerba Lindl. (Rhamnaceae), a deciduous tree of the Sino-Japanese region, is reported here as a new record for the flora of Jammu and Kashmir based on specimens collected from Jammu province, North-Western Himalaya. Although earlier literature subsumed this taxon under *Hovenia dulcis* Thunb. *sensu lato*, a critical re-examination of morphological characters including leaf apex shape, inflorescence symmetry, style division and sepal venation substantiates the recognition of *H. acerba* as a distinct taxon. The present contribution provides a detailed morphological description, a dichotomous identification key to Indian *Hovenia* taxa, updated distributional records, discussion placing the species within the Sino-Himalayan floristic element and notes on its ecology and conservation status under IUCN criteria. The discovery validates the significance of the Western Himalayan hotspot as a home for Asian disjunct taxa and highlights the need for intensified botanical exploration in these botanically rich but less explored regions.

INTRODUCTION

Rhamnaceae Juss. is a cosmopolitan family of the order Rosales [1], predominantly distributed in tropical and subtropical regions of the world. The family comprises approximately 55–60 genera and 900–1,000 species, including trees, shrubs, lianas, and, less frequently, herbaceous taxa [27]. The genus *Hovenia* Thunb. (Rhamnaceae: tribe Paliureae) comprises approximately five species of deciduous trees and shrubs distributed across the warm-temperate Sino-Japanese floristic region, extending westwards into the foothills of the Himalayas [24, 31]. The genus is morphologically distinguished by its trilocular capsular fruits borne on fleshy, edible and sweet peduncles (pseudofruits) that serve as effective zoochorous dispersal units [4].

Within the Indian subcontinent, the occurrence of *Hovenia* species has been documented primarily from the Garhwal Himalayas of Uttarakhand and the northeastern state of Arunachal Pradesh. Historically, all Indian material was cited under *Hovenia dulcis* Thunb., the type species of the genus, following a broadly circumscribed species concept that included the Himalayan populations as mere variants of the widespread Asian *H. dulcis* [5, 10, 19, 30, 34]. However, Lindley (1820) had already recognized a distinct Himalayan species, *H. acerba*, described from a plant grown in Lambert's greenhouse in Boyton (England), from seeds sent by Wallich from Calcutta, which had themselves been introduced into the Sibpur (Calcutta) Botanic Garden by Buchanan-Hamilton from Nepal, originally deriving from China [36].

Kimura's (1939) monographic revision of *Hovenia* treated *H. acerba* as native to China and distinct from the Japanese *H. dulcis*, an interpretation subsequently adopted by Momiyama (1966) and Hara (1979) for the flora of eastern Himalayas and Nepal. A thorough re-examination of Central National Herbarium (CAL) material by Sengupta & Safui (1984) revealed that *H. acerba* merits taxonomic recognition at varietal rank as *H. dulcis* var. *acerba*, on the basis of characters such as the predominantly long-acuminate leaf apex, the tendency towards axillary-symmetrical inflorescences, style arm division

extending from a quarter to two-thirds of the style length and the presence of anastomosing nerves on sepals characters not fully encompassed by the typical variety *H. dulcis* var. *dulcis*.

The broader context of Tertiary floral exchange between East Asia and the Indian subcontinent well documented in the fossil wood record, including the discovery of fossil *Hovenia* wood from the late Eocene Florissant Formation of Colorado by Wheeler & Meyer (2012) lends palaeo-biogeographic importance to present-day occurrences of East Asian taxa on the Indian subcontinent.

The present paper formally documents *H. acerba* Lindl. as a new record for the Jammu and Kashmir on the basis of newly collected fresh specimens; provides a detailed morphological description following current standards; presents a dichotomous key for Indian *Hovenia* taxa; and briefly considers ecology and IUCN conservation status.

MATERIALS AND METHODS

Extensive field surveys were conducted in Rajouri and Bani region of union territory of Jammu and Kashmir, India and adjoining forest areas, as part of ongoing floristic investigations in the North-west Himalaya. Fresh specimens were collected from natural populations occurring on open hill slopes following standard botanical collection procedures [9]. Collected specimens were carefully sampled, tagged, pressed, dried, poisoned, and mounted according to conventional herbarium techniques [32]. Voucher specimens were deposited in the Herbarium of the Department of Botany, University of Jammu (HBJU 18652;18653), Jammu for future reference and authentication. Morphological observations were made both in the field and laboratory. Photographs of the habit, habitat, and diagnostic morphological characters were captured using a Nikon D5600 DSLR camera. Detailed examination of vegetative and reproductive structures was carried out under a Nikon SMZ-800 stereomicroscope and micro-morphological features were documented photographically. Morphological measurements were obtained following standard taxonomic protocols and are presented as ranges based on the examined material. Identification of the collected taxon was accomplished through critical comparison with relevant taxonomic literature, regional floras, monographs, original protologues and authenticated herbarium specimens [13, 18, 40, 47, 48]. Notably, the species has not been recorded from the union territory of Jammu and Kashmir as confirmed from the above cited data. Herbarium specimens preserved at major Indian herbaria, including the Central National Herbarium (CAL), Howrah; Forest Research Institute Herbarium (DD), Dehradun; Botanical Survey of India Herbarium (BSD) Dehradun; and Janaki Ammal Herbarium, CSIR–Indian Institute of Integrative Medicine (RRLH) Jammu were critically examined for comparative study and confirmation of identity. Herbarium acronyms follow Index Herbariorum (Thiers, 2026, continuously updated).

Nomenclatural information and current taxonomic status were verified using the International Plant Names Index (IPNI), Plants of the World Online (POWO) and World Flora Online (WFO). A comprehensive review of published literature, floristic accounts and regional plant inventories was undertaken to assess the distributional status of the taxon within Jammu and Kashmir. This investigation revealed that the

species has not previously been reported from Jammu and Kashmir, thereby representing a new distributional record for the union territory of Jammu and Kashmir. Where applicable, a preliminary conservation assessment was conducted following the IUCN Red List Categories and Criteria [16]. The Extent of Occurrence (EOO) and Area of Occupancy (AOO) were estimated using the GeoCAT tool [3].

TAXONOMIC TREATMENT

Hovenia acerba Lindley, Bot. Reg. 6: t. 501. 1820.

Basionym- *Hovenia dulcis* var. *acerba* (Lindl.) Sengupta & Safui, Bull. Bot. Surv. India 26(1–2): 55 (1985).

Vernacular name- *Chakhoon*

DESCRIPTION

Trees deciduous, 10–25 m tall; bark grey-brown, fissured on mature individuals, lenticellate on younger branches. Branchlets terete, glabrous to sparsely puberulous when young, becoming glabrous with age, marked by persistent, semi-circular leaf scars. Stipules deciduous, lanceolate, 4–8 mm long, pubescent along margins. Leaves alternate, broadly ovate to ovate-elliptic, 8–18 × 5–13 cm; base oblique, broadly cuneate to subcordate, 3-nerved from the base; margins serrulate to crenate-serrulate, teeth callous-tipped; apex predominantly long-acuminate, 1.0–2.5 cm acuminate, upper surface glabrous, shiny, lower surface sparsely pilose along the primary and secondary veins; secondary veins 4–6 pairs; petiole 2.0–4.5 cm long, canaliculate, puberulous. Inflorescences cymose, terminal and axillary; terminal inflorescences mostly asymmetrical; axillary inflorescences symmetrical; rachis puberulous; bracts linear-lanceolate. Flowers bisexual, 5-merous, 4–5 mm in diameter, yellowish-white, fragrant; pedicels 2–5 mm long, slender, puberulous. Sepals 5, deltoid-ovate, 2.0–2.5 mm long, keeled inside, with anastomosing nerves. Petals 5, obovate-spathulate, 2–2.5 mm long, concave, clawed at base, hooding the stamens at anthesis; apex obtuse to emarginate. Stamens 5, opposite the petals, filaments subulate, anthers dorsifixed, introrse. Disc fleshy, pentagonal, adnate to the calyx tube. Ovary 3-locular, immersed in the disc; style 3-partite from a quarter to two-thirds of its length. Fruit, trilocular capsule, globose, 5–7 mm in diameter, trigonous-globose when dry, dark purplish-brown; pseudofruits fleshy and clavate at maturity, 2–5 cm long, sweet and edible. Seeds 1–3, broadly ovoid, smooth, reddish-brown, 3–4 mm long.

PHENOLOGY

Flowering from May to July; fruiting from August to October.

HABITAT AND ASSOCIATED SPECIES

H. acerba in the Indian subcontinent inhabits mixed broad-leaved deciduous and semi-evergreen forests at elevations of 1430–1970 m, typically on well-drained, deep, moist and fertile loamy or sandy-loam soils with good organic content. Associated canopy species recorded at the locality include *Alnus nepalensis* D.Don, *Quercus glauca* Thunb., *Morus serrata* Roxb. and *Machilus gamblei* King ex Hook.f..

Identification Key to Indian Hovenia Taxa

- 1. 1. Inflorescences terminal, rarely axillary, arranged in asymmetrical cymose panicles; style undivided or only shortly branched; fruits black at maturity, 6.5–7.5 mm in diameter; leaf margins irregularly to coarsely serrate **H. dulcis**
- 2. 2. Inflorescences terminal or axillary, arranged in symmetrical dichasial cymose panicles; style deeply branched to at least half its length; fruits yellow at maturity, 5.0–6.5 mm in diameter; leaf margins shallowly and obtusely serrulate **H. acerba**

Specimens Examined

India. Jammu and Kashmir, Kathua, Bani, Sand Roohn, 32°43'55.91"N 75°50'47.09"E", 1640m, 16 June 2026, Sunit and Udhay 16VI26A (HBJU!); Jammu and Kashmir, Kathua, Bani, Barmota, 32°45'52.08"N 75°48'37.34"E, 1550m, 17 June 2026, Sunit and Udhay 17VI26A (HBJU 18652!) ; Jammu and Kashmir, Rajouri, Manjakote Ghambir Mughlan Goral Conservation Reserve (Wildlife Protected Area) 33°31'53"N 74°18'18"E 1419m, 15th September, 2025 Iftikhar H. Khan and O. P. Sharma 15IX25A (HBJU 18653!)

PHYTOGEOGRAPHY AND DISTRIBUTION

H. acerba belongs to the Sino-Japanese floristic kingdom, a major phytogeographic unit that encompasses the warm-temperate deciduous and mixed broad-leaved forests of eastern China, Japan, the Korean Peninsula, and the eastern Himalayan foothills [11, 42]. The extension of this floristic element into the Indian subcontinent documented for numerous genera including *Zelkova*, *Cyclocarya*, *Eucommia*, *Koelreuteria* and *Paliurus* is a well-recognised biogeographic pattern attributable to Tertiary land bridges and subsequent vicariance following tectonic and climatic events [25, 44].

Within India, confirmed occurrences of *H. acerba* are restricted to the sub-tropical to warm-temperate belt of the Western Himalayas (1000–1800 m). The species extends into Nepal [12], Bhutan, and the mountains of Yunnan, Sichuan, Guizhou and Hunan provinces in China [21, 31]. The Indian populations therefore represent the south-western periphery of the species distributional range and are consistent with the broader pattern of Sino-Himalayan disjuncts characterising the floristic assemblages of these regions [22].

Conservation status

Despite several extensive investigations from 2024 to 2026 in allied parts of Jammu& Kashmir, only Six populations were located, and this study included counting of mature individuals and few germinating saplings in two consecutive years. In total, nearly 76 mature individuals were counted in three locations. Sand Roohn and Barmota areas have populations with around 25 plants each. The plant species is locally called 'Chakhoon/ Changool' Fleshy peduncle and the fruits are edible and are eaten by the wild animals in the early stages of the fruit development, habitat fragmentation, road construction, and other development activities are another key factor for its declining status. Therefore, all these factors have contributed to its very low population size. The EOO for *Hovenia acerba* is only and AOO was 12 km². The number of mature individuals in all three populations ranged from 70 to 80 individuals, i.e., < 2500 individuals. Hence, *Hovenia acerba* categorized (following IUCN 2025) as Endangered (EN).

DISCUSSION

The recognition of *H. acerba* as a component of the Indian flora contributes to a growing body of floristic evidence for the Sino-Himalayan element in Indian biodiversity. The morphological characters separating *H. acerba* from *H. dulcis* particularly the extent of style division and the tendency toward symmetrical axillary inflorescences while individually variable, show a consistent trend across examined Indian specimens and align with those documented in Chinese material by Kimura (1939) and in Himalayan material by Hara (1979).

Molecular phylogenetic studies are needed to rigorously assess species limits and infraspecific relationships within the genus, particularly given the overlapping quantitative variation documented by Kimura (1939), Sengupta & Safui (1984) and the present study. The genus has received minimal molecular attention relative to its ecological and biogeographic importance.

CONCLUSIONS

Hovenia acerba Lindl. is formally documented as a new addition to the flora of India, based on a critical re-examination of historical herbarium specimens from the Central National Herbarium (CAL) and the Forest Research Institute Herbarium (DD), supplemented by new collections from Jammu & Kashmir. A morphological description, diagnostic key, distributional records, phytogeographic assessment, and preliminary conservation evaluation are provided. Intensified botanical surveys across under-explored Himalayan tracts and molecular phylogenetic studies of *Hovenia* are recommended to further clarify species limits and population dynamics of this biogeographically significant genus.

Declarations

Conflict of Interest

The authors declare no conflict of interest.

Ethical approval and Consent to Participate

The ethical guidelines for the collection and identification of plant specimens were strictly followed throughout the study. Field surveys and specimen collection were conducted in accordance with the applicable regulations and guidelines governing biodiversity research in India. Plant specimens were collected from natural populations in Jammu, northwestern Himalaya and were identified using standard taxonomic methods. Voucher specimens have been deposited in the Herbarium of the Department of Botany, University of Jammu (HBJU), for future reference. The collection number of each species has been mentioned along with the description.

Consent to participate

Not applicable.

Consent to publication

Not applicable.

Clinical trial number

Not applicable.

Plant collection permissions and guidelines

The collection of plant material complied with relevant institutional, national and international guidelines and legislation. Plant specimens were collected during botanical field surveys with the permission of the concerned landowners and the competent authorities wherever required. Collection activities were conducted in accordance with the regulations of the Department of Forest, Ecology and Environment, Government of Jammu and Kashmir, India. Voucher specimens were prepared following standard herbarium procedures and deposited in the Herbarium of the Department of Botany, University of Jammu (HBJU). No protected or endangered species were collected during this study. Species identification was done by Om Prakash Vidyarthi (Retd. IFS & Member of JK Biodiversity Council, Forest, Ecology and Environment Department, Jammu and Kashmir), Dr. Anant Kumar (Assistant Professor, Hemvati Nandan Bahuguna Garhwal University, Uttarakhand) and Dr. Sunit Singh (Postdoctoral fellow JU).

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The authors have nothing to report.

Author Contribution

S.S., U.S., O.P.V and I.H.K. do the fieldwork and collection; S.S. and U.S. wrote the draft, S.S. prepared the distribution map and U.S. prepared photoplate. O.P.V, S.S. refined the manuscript.

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Data availability

No data were generated or analysed in support of this study.

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Figures

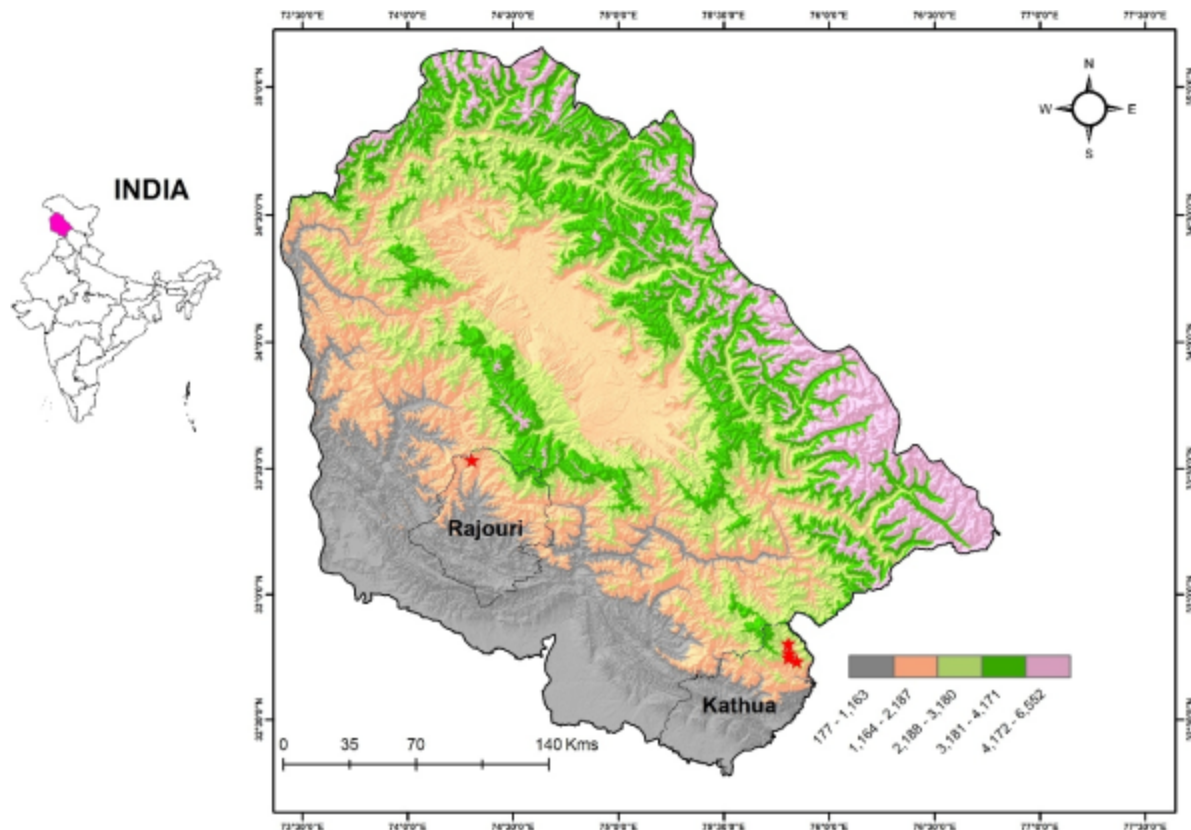


Figure 1

The location map shows the distribution of *Hovenia acerba* in Kathua and Rajouri District, Jammu and Kashmir, India.

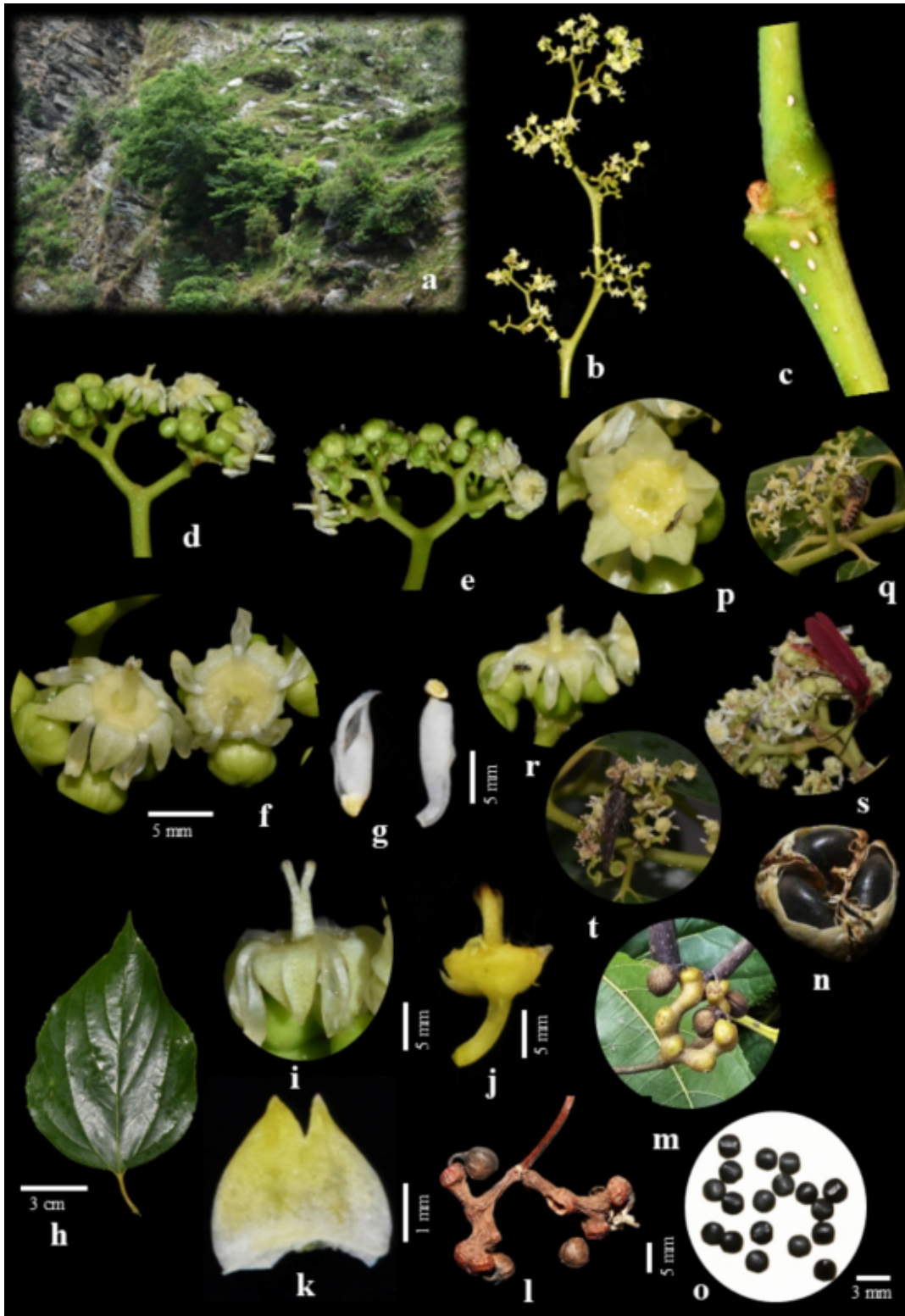


Figure 2

Hovenia acerba; a. Habitat, b. Inflorescence, c. Node (Swollen), d-e. Adaxial and abaxial side of floral axis, f. Flower closeup, g. Stamens, h. Leaf, i. Flower, j. Pistil, k. Sepals, l-m. Fruit with pseudofruit (fleshy peduncle), n-o. Seeds, p-t. Floral visitors.